

Mine Identification Using STIL Technology

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LONG TERM GOAL

The overall goal of the Streak Tube Imaging LIDAR (STIL) project is to develop a mine identification capability, specifically to use STIL technology to demonstrate the technical feasibility of providing a tactical mine identification capability to airborne mine countermeasures (AMCM) forces. The projected payoff is a decrease in mine clearance time, an increase in clearance effectiveness, and a reduction in the cost per mine cleared. The resulting system must be compatible and interchangeable with the AN/AQS-20 volume search sonar (VSS) section.

OBJECTIVES

The overall objective of this three year collaborative effort between Arete Associates and Coastal Systems Station (NSWCCSS), Panama City, FL is to directly demonstrate the capability of STIL to perform electro-optic identification (EOID) of bottom and close tethered mines from an underwater towed vehicle (AN/AQS-20) at tactically significant speeds, swath widths, and standoff ranges.

The objective of this first year's effort is to (i) directly demonstrate high resolution 3-D imaging in the ocean at tactically significant ranges, and in parallel (ii) perform system engineering and design to address the integration of the STIL-EOID sensor into the AN/AQS-20 towed body (TB).

The objective for FY99 is to complete integration of the sensor into the TB, allowing ocean testing in the final compact, rugged configuration to begin in FY00.

APPROACH

The overall approach is to perform design, fabrication, integration, and testing of a compact, robust STIL system, and to directly demonstrate high-resolution 3-D imaging of mines at speeds, ranges, and swaths of tactical relevance.

In a joint developmental approach, Arete is developing the laser design while NSWCCSS is designing the housing. Additionally, due to unavailability of the AN/AQS-20, NSWCCSS is modifying an existing prototype platform to provide commonality with the AN/AQS-20 vehicle motions and controls.

In parallel with the program, Arete is developing an Interim Demo System that is a subset of the planned EOID. It is a subset because it contains one camera (rather than two) and is not size limited. The Interim Demo System will provide valuable risk reduction for the design concepts to be used in the final EOID configuration. The Interim Demo System was built and tested for proof of concept and its ability to identify mines. While the Interim Demo System is being developed, Arete is also developing a miniaturized design that will fit inside the AN/AQS-20 prototype. NSWCCSS is assisting in the Interim Demonstrations with environmental testing, targets, and data analysis support.

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NSWCCSS's overall approach is: to design and fabricate the STIL housing; refurbish the AN/AQS-20 prototype TB to more closely match the performance and size of the actual AN/AQS-20 TB; perform risk reduction tests, design and fabricate a new hull section; integrate prototype TB components and STIL housing with the new hull; and perform testing on the STIL Demo TB. In addition, NSWCCSS is providing a "fit-check model" of the housing section for Arete to verify the mechanical design, thereby reducing cost and time in the final integration.

WORK COMPLETED

- Conducted Preliminary Design Review (PDR) in the 3rd quarter of FY98. An Interim Progress Review (IPR) was held in 1st quarter of FY99. During the IPR, the Catalina Quick Look Report was reviewed.
- Created an interface working group with Raytheon (AN/AQS-20 prime contractor) and Program Executive Office, Airborne Mine Defense (PMS 210) participation. This group is looking ahead to the AN/AQS-20/X program and the need for an EOIDS system that is compatible and interchangeable with the VSS section.
- Conducted AN/AQS-20 Altimeter, Sonar and Bottom Following Mode (BFM) Verification Test (Mar-Apr 97). The vehicle motions measured were all within the STIL requirements for the given test conditions (i.e., 200 ft of water, 36-ft altitude, BFM, and speeds of 8, 10, and 12 kn).
- Conducted an ocean test of the Interim Demo System at Catalina Island (8-14 Sep 98). Results included very successful demonstration of EOIDS capability and a resolution to design point in clear water.
- Completed the designs for modifying the prototype TB to accept the STIL system and to mimic the AN/AQS-20 TB in performance.
- Completed initial designs of the STIL housing section of the TB. Designs will be finalized upon specification of the final STIL components.
- Resolved integration issues and questions for ultimate incorporation into the AN/AQS-20, including weight and power budgets, physical constraints, and environmental requirements.

RESULTS

- The results of the above demonstrations and risk reduction testing provide early evaluation of advanced system design to allow for fine tuning of the EOIDS configuration.
- Results from the EOIDS demonstration conducted on a glass bottom boat in Catalina Island during 8-14 Sep 98 included:
- Demonstration of design resolution in clear water
- Critical hardware designs proven out
- Collected significant system data for performance analysis and use in modeling
- Identified several incremental improvements and lessons learned that will be incorporated for the Gulf of Mexico (GOM) test scheduled to be conducted in Mar 99.
- The environmental data collection system experienced a failure; however, data can be reconstructed at the conclusion of the GOM test.
- The system operator display has been reviewed by Fleet operators with their input fully incorporated.

Working closely with both Arete and their subcontractor, Metro Engineering, the final component configuration is nearing completion proving that the system can be compact enough to

provide a “plug-and-play” EOID capability and will not exceed the extremely tight weight budget of the AN/AQS-20 system.

IMPACT

The ability to quickly distinguish actual mines from mine-like objects and other bottom clutter will significantly improve the ability of the Fleet to make informed decisions about the risk to transitors. Because the AN/AQS-20 is a high speed platform with good target localization, it is the ideal candidate for a modular EOID system. The AN/AQS-20/X, when employed with the H-60 variant helicopter, will be the first high-speed reconnaissance and identification system that is organic to the Fleet. Because the STIL system is modular and compact enough for “plug-and-play” operation in the AN/AQS-20, it will be a strong contender for implementation in the final AN/AQS-20/X system.

TRANSITIONS

Sensor engineering and design is based on common interfaces with the VSS sensor section of the AN/AQS-20 Engineering Development Model (EDM) vehicles. This approach allows straightforward integration of an EOID capability into the AN/AQS-20 AMCM sensor system. The expectation is to transition the project to the Airborne Mine Countermeasures Program development line (PE0604373N) under PMS 210 upon completion of this three-year effort.

RELATED PROJECTS

- Fluorescent receiver - Arete has done preliminary design modifications to incorporate a fluorescence receiver as part of the STIL design, which would serve as an additional target discriminator.

Reacquisition analysis; this effort is being led by the AN/AQS-20 team with substantial participation by the STIL program. This will identify the total error involved in target localization and define the tactics to be used for follow-on identification.

REFERENCES

None.

PUBLICATIONS

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PATENTS

None.